PATENT SPECIFICATION

Convention Date (United States): June 16, 1928. **313,582**

Application Date (In United Kingdom): Sept. 5, 1928. No. 25,498/28.

Complete Accepted: Dec. 5, 1929.

COMPLETE SPECIFICATION.

Improvements in or relating to Method of and Apparatus for Pulverizing and Treating Materials.

We, ERIE CITY IRON WORKS, a corporation of the State of Pennsylvania, United States of America, of East Avenue, and N.Y.C.R.R., Erie, Pennsylvania, United States of America, Assignees of WALTER JACOB WOHLENBERG, a citizen of the United States of America, of 54, Hubinger Street, New Haven, State of Connecticut, United States of America, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention is directed to the treatment and pulverization of material and is of particular advantage in the pulverization of fuel which is directly delivered to a burner. According to the present invention there is provided a pulverizer particularly for pulverizing material such as fuel to be fed to a furnace and which includes means for feeding the material to a passage and the driving thereof at high velocity by a gaseous fluid moving through the passage, which comprises a pulverizing impact wall against which the material is thrown by the action of the gaseous fluid, and a means to separate, after the pulverization, the finer material from the coarser and to further pulverize the coarser material by the driving action of the gaseous fluid.

There is associated with the impact wall a deflecting surface against which the moving material acts so that the deflection induces abrasive impingement of the material on the deflecting surface.

In order that the invention may be clearly understood reference will now be had to the accompanying drawings wherein a preferred embodiment of the apparatus is illustrated;—

Fig. 1 marks a side elevation of the apparatus, partly in section.

Fig. 2 a plan view, partly in section.

Fig. 2a a horizontal section on the line 2a—2a in Fig. 1.

Figs. 3, 4, 5, 6 and 7 various forms of abrasive coils.

Figs. 8, 9, 10 and 11 various forms of cross section of abrasive tubes.

Figs. 12, 13, 14 and 15 various modifications.

A furnace 1 as illustrated is used with a steam generator 2.

The initial pulverizing unit 3 is in the form of an ordinary coil of pipe of comparatively restricted cross section. It affords a continuing deflected surface against which the fuel is thrown as it is driven by the gaseous fluid with abrasive impinging action which pulverizes the material to a very high degree of fineness and with a minimum of driving energy. This pulverization is accomplished by a continuous deflected movement as distinguished from impact.

Various coils may be used as the coils 4, 5, 10 and 11 of Figs. 3, 4, 6, and 7 and these may be of various cross sections as indicated by 3a, 3b, 3c, and 3d in Figs. 8 to 11. The deflecting path 6 may be formed by a twisted plate 8 in a tube 7, as shown in Fig. 5.

Such deflected wall may also be accomplished by utilizing the deflected walls of a chamber 12 (Fig. 1) having an intake 13 along the line of the wall and providing a vertical axial discharge as at 14. Here the driving force of fluid impels the coal against and along the wall and this abrasive impingement pulverizes the coal, the coarser particles following the wall and the finer particles being discharged. The chamber 12 may also be supplied with a discharge passage 15 at the bottom so that material may be discharged from the chamber 12 prior to complete pulverization the chamber 12 operating not only as a pulverizer but as a separator, the finer material discharging at 14 and the coarser material at 15. The material is carried from the discharge 15 to a secondary pulverizing unit 16. The unit 16 is preferably of coil form, smaller in cross section and of smaller diameter than the unit 3, thus increasing the velocity and giving a sharper deflection to the material to increase the abrasive action. The discharge 15 may be divided and a plurality of units 16 used (see Fig. 2). The units 3 and 16 operate in series while the units 16 operated in parallel. The finer material passing from the cham-

ber 12 to the outlet 14 is carried by pipes 17, 18 and 19 to burners 20 and 21.

The units 16 discharge to pulverizer separators 22, these separators being of volute form having intakes 23 and annular impinging walls 24. Discharges 25, Fig. 2a, are made in the form of narrow slots which may have guide vanes, if desired. These slots are immediately increased in width decreasing the velocity and increasing the pressure of the driving fluid as it passes to the discharges 25. The discharges 25 lead to the pipes 18 and 19 and thence to the furnace. The case is made in halves and the width of the slot 25 may be varied by shins between the case halves. The discharge 14 is provided with a valve 26 by which the discharge of material from the chamber 12 may be regulated and the proportions discharged through the pipes 14 and 15 controlled.

Any gaseous fluid may be used but I prefer air particularly in pulverizing fuel. Air is supplied by an air pump 27. The pump delivers air through a pipe 28 to a heater 29. As shown the heater comprises a series of tubes 30 through which the air passes. Hot gases from the furnace are delivered through a pipe 32 to a heater chamber 33 and are drawn off from the chamber by a pipe 34 by means of a fan 35. A pipe 36 leads from the fan back to the furnace chamber. The heated air is carried from the heater by way of a pipe 37 to the intake side 38 of a Venturi tube 38a. Fuel is delivered to the intake from a feeder 39.

Fuel and air are delivered from the Venturi 38a to a breaker 40, this breaker consisting of an enlargement of the passage forming a chamber in which chamber is arranged an impact wall 41 directly facing the direction of movement of the fuel as it emerges from the Venturi tube. The fuel and air emerging from the breaker 40 passes through a second Venturi 42 speeding up the fuel and is delivered to a second breaker 43 similar in construction to the breaker 40 having an impact wall 44 and the broken fuel is delivered from the breaker 44 to the initial pulverizing unit 3.

The Venturi in advance of these impact breakers increases the velocity of the fuel which increased velocity is maintained through its inertia to the point of impact. The breaking may be accomplished more economically with a plurality of breakers operating at lower velocities than with a single breaker with a higher velocity.

A regulated feeding of the fuel may be accomplished in a convenient manner as shown. An air lock scheme of fuel delivery may be used involving a hopper 46 receiving the fuel, an air lock chamber 47 below the hopper and an air-lock chamber 48 below the chamber 47. Valves 49 and 50, are provided for these chambers, these valves being supplied with operating means 49a and 50a so that coal may be passed from one to the other alternately and the chambers sealed between operations. Air may be delivered to the chambers 47 and 48 by way of pipes 51 leading from the pipe 37 and valve-controlled branch pipes 52 and 53. The material is deposited from the chamber 48 upon a revolving feed table 54. A scraper 55 operates above this table and may be adjusted by a wheel 56 in the usual manner to vary the feed, the fuel being delivered from the feeder 39 to the inlet 38. The table 54 is driven through a shaft 57 from a motor 58.

In the operation of the apparatus air is driven from the pump 27 and given sufficient pressure to assure a high velocity through the various passages. The air picks up the fuel from the fuel feeding devices 39, drives the fuel at high velocity against the impact breakers 40 and 43, thus breaking it into small lumps, the velocity at the breakers being increased by the Venturis. The fuel so broken is carried at high velocity through the unit 3, the abrasive action in this unit accomplishing pulverization. From the unit 3 it is carried to the pulverizing separator 12. The finer particles are delivered directly to the burners by way of the discharge 14. The coarser particles are carried through the secondary pulverizer units 16 arranged in parallel to each other and in series with the initial pulverizer. The discharged material from the secondary units 16 is carried through the impinging pulverizing and separating units 22 and the final controlled discharge from the units 22 assures the desired fineness and this is delivered to the burners with the finer material from the separator 12.

By heating the air not only is the air expanded and its energy increased but this added temperature acting on the fuel tends to absorb a greater proportion of its moisture putting it in condition to be more readily pulverized and the added heat also assists in the combustion of the fuel.

The number of breakers, the arrangement of pulverizer units, and the separation and distribution of the fuel as it advances may be varied in accordance with the fuel operated upon.

In Fig. 12 the pulverizer units 59 are arranged in parallel. They receive material from a breaker 60 having a rotating beater 61. The beater receives

its power from a motor 62. Air under pressure is delivered from a pipe 63 through a Venturi tube 64 and the fuel is fed from a hopper 65 to the restricted portion of the Venturi 64, the Venturi inducing a flow of material from the hopper to the air passage.

Fig. 13 illustrates a modified fuel feeder. It consists of a feeder and breaker. Breaker rolls 66 are provided receiving fuel from a screen 68, the rolls and screen being arranged in a hopper 67. The screen is shaken by a bell crank lever 69 receiving its movement from a motor 70 through a crank 72 and link 71. Fuel is delivered to the screen from a pipe 73 and discharged from the hopper by a pipe 74 to the fuel intake of the apparatus.

Fig. 14 shows a series of pulverizer units and separators between these units. An initial unit 75 leads to a separator 76 similar to the separator 12. The fine material is discharged through a pipe 77 controlled by a valve 78 and thence by a pipe 79 to the pipe 79a leading to the burner. The coarser material is delivered from a discharge 80 to a secondary unit 81 and thence to a second separator 82 similar to the unit 76. The finer material is discharged from the second separator 82 through a pipe 83 leading to the pipe 79, the pipe 83 being controlled by a valve 84. The coarser material 85 is discharged to a coil unit 86 discharging through a pipe 87 to the pipe 79a.

Fig. 15 shows a series of pulverizer units 88 arranged in parallel. The fuel is fed to a common fuel feeding device 89 through a pipe 90. The fuel feeding device is similar to the fuel feeding device 39 except that there are three discharges 91 and a scraper for each discharge 91. Air is delivered from a pipe 92 through pipes 93 and the discharges 91 lead to restrictions 94 in Venturis leading to the pulverizing units 88.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. A pulverizer particularly for pulverizing material such as fuel to be fed to a furnace and which includes means for feeding the material to a passage and the driving thereof at high velocity by a gaseous fluid moving through the passage, which comprises a pulverizing impact wall against which the material is thrown by the action of the gaseous fluid, and a means to separate, after the pulverization, the finer material from the coarser and to further pulverize the coarser material by the driving action of the gaseous fluid.

2. A pulverizer according to claim 1, in which there is associated with the impact wall a deflecting surface against which the moving material acts so that the deflection induces abrasive impingement of the material on the deflecting surface.

3. A pulverizer according to claim 2, in which the deflecting surface is provided by a coiled pipe.

4. A pulverizer according to claim 2, in which both the impact wall and the deflecting surface act upon the material prior to the separation.

5. The invention according to claim 1 or 2, comprising a plurality of impact walls in which there is an initial unit and a plurality of secondary units to increase the pulverizing action, the secondary units being in series with the initial unit and parallel to each other.

6. A pulverizer according to claim 1 or 2, in which there are a plurality of secondary units in series with the initial unit and separators between the initial unit and each secondary unit discharging its coarser material to the secondary unit.

7. A pulverizer according to claim 1 or 2, in which a heater is provided for heating the gaseous fluid between the means generating the initial pressure on the gaseous fluid and the pulverizing means.

8. The method of pulverizing material in accordance with the apparatus of claim 1 or 2, which consists in driving the material with gaseous fluid at high velocity and in heating the gaseous fluid between the point of generating the pressure on the gaseous fluid and the pulverizing means.

9. A pulverizer having its parts constructed, arranged and adapted to operate substantially as hereinbefore described with reference to the accompanying drawings and for the purpose specified.

Dated the 5th day of September, 1928.

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313,582 COMPLETE SPECIFICATION

SHEET 1

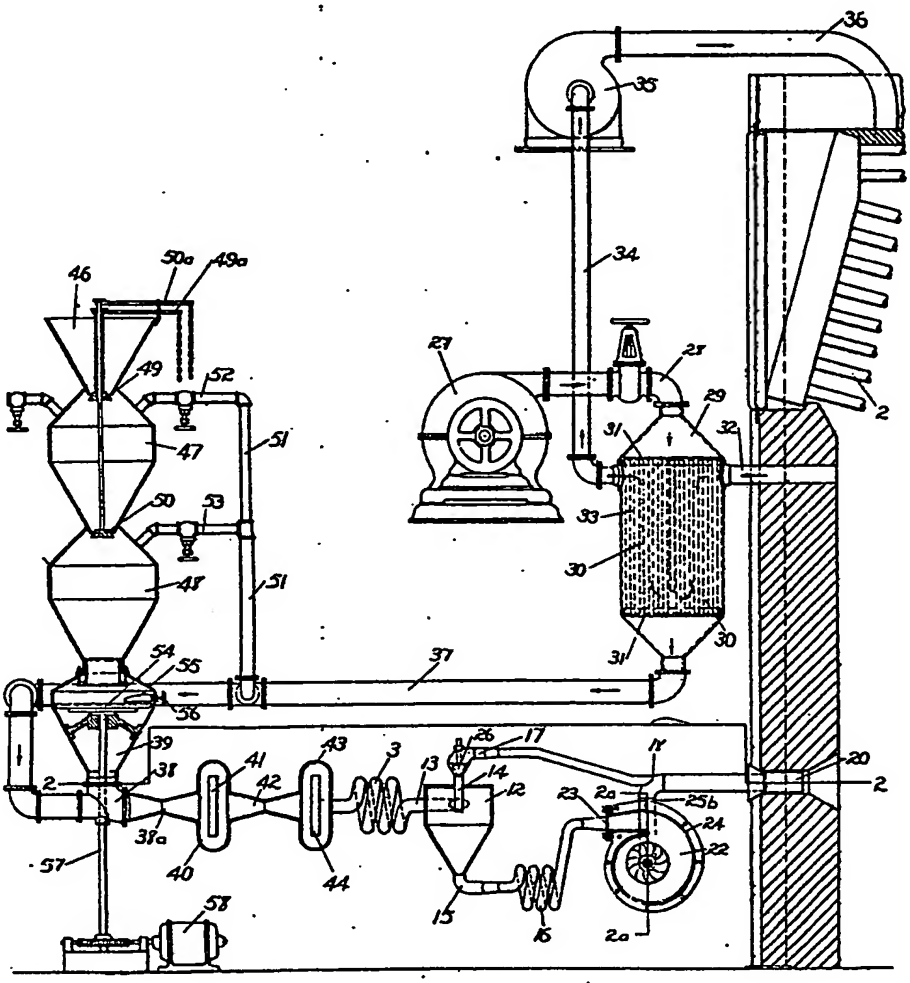

Fig 1

[This Drawing is a reproduction of the Original on a reduced scale.]

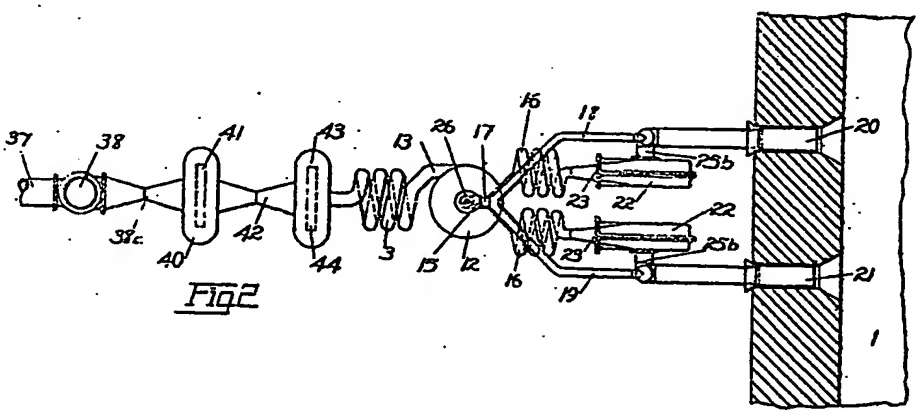

Fig2

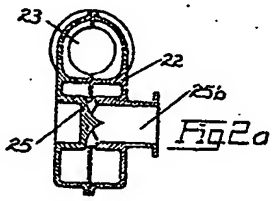

Fig2a

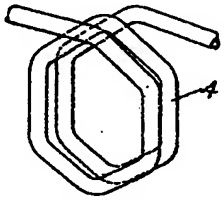

Fig3

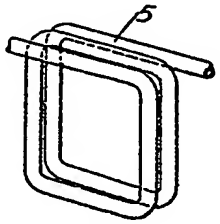

Fig4

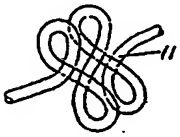

Fig7

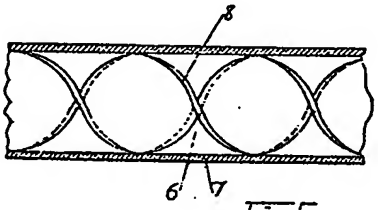

Fig5

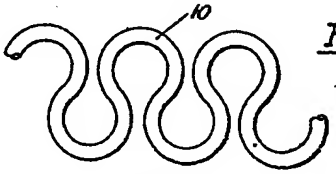

Fig6

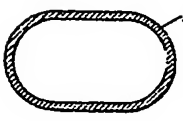

Fig8

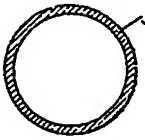

Fig9

Fig10

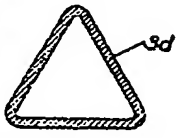

Fig11

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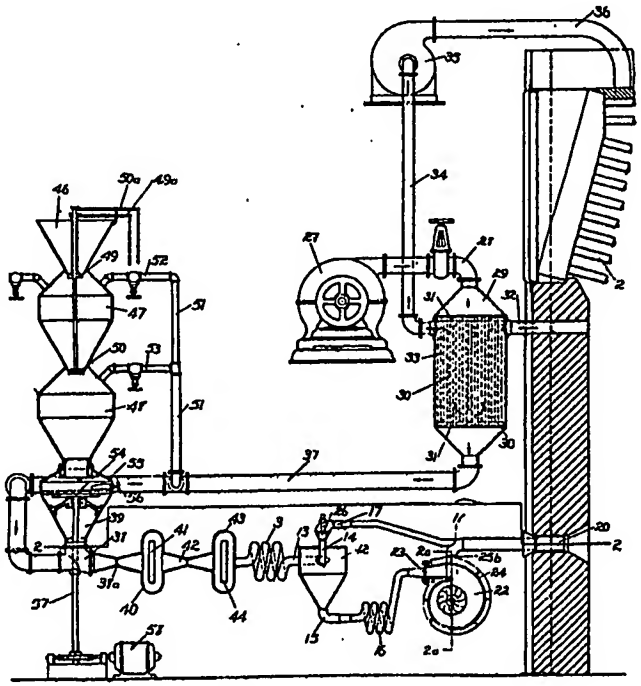

Fig.1

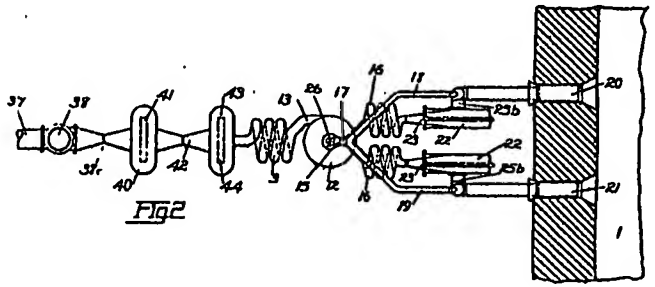

Fig.2

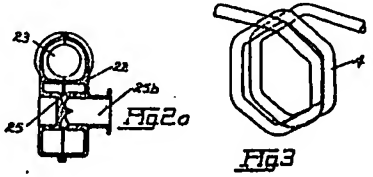

Fig.2a

Fig.3

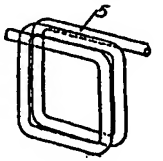

Fig.4

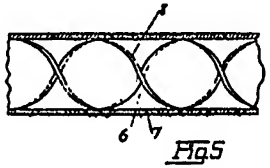

Fig.5

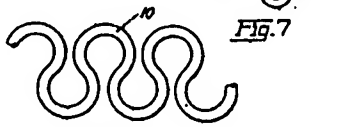

Fig.6

Fig.7

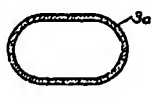

Fig.8

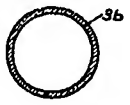

Fig.9

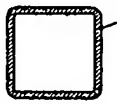

Fig.10

Fig.11

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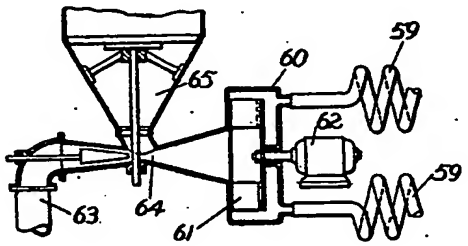

Fig.12

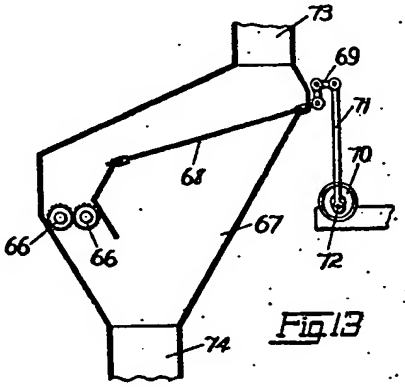

Fig.13

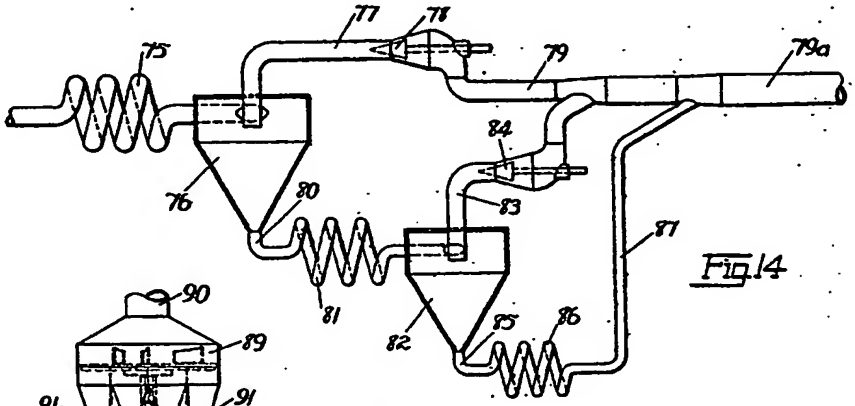

Fig.14

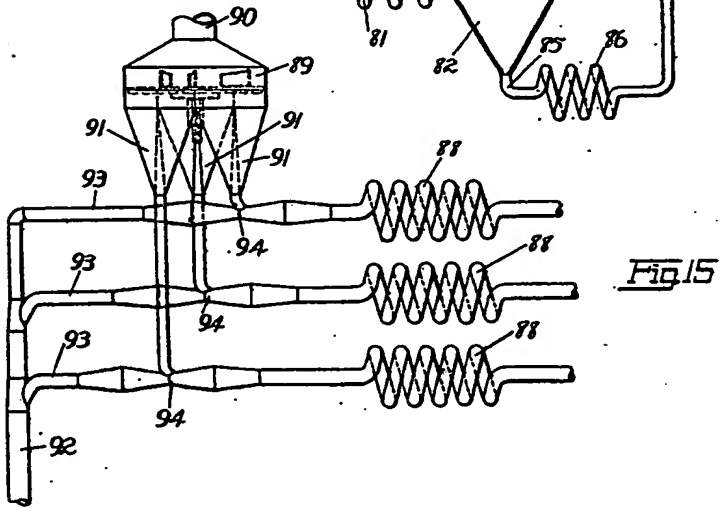

Fig.15

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